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EXAMINER

GEBREMARIAM, SAMUEL A

ART UNIT PAPER NUMBER

2811

DATE MAILED: 04/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/668,702

Applicant(s)

LIN ET AL

Examiner

Samuel A. Gebremariam

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11 March 2005.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17 and 21-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 and 21-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Objections*

1. There are two claims that are numbered claim 22. Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 3-5, 12-14, 16-17 and 21-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Wu et al., US patent No. 6,013,581.

Regarding claim 1, Wu teaches (figs. 2A-2E) a semiconductor device having a first layer (206a) underlying a second layer (226), the method comprising: forming a glue layer on the first layer (208); performing an inter-treatment on the glue layer (208); wherein the inter-treatment affects the upper and lower surfaces of the glue layer and improves an adhesive interface between the glue layer and the first layer (col. 3, lines 37-50, since layer 208 is exposed to the plasma treatment the upper and lower surface of 208 are affected); and depositing the second layer (226) onto the upper surface of the inter-treated glue layer (208), wherein the inter-treated glue layer improves the adhesion between the first (206a) and the second layers (226).

The limitations of “a method for increasing a time dependent dielectric breakdown lifetime of a semiconductor device” is not given patentable weight because a

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recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Furthermore since Wu teaches the same claimed process, Wu's process is inherently capable of increasing a time dependent dielectric breakdown lifetime of the semiconductor device.

Regarding claim 3, Wu teaches the entire claimed process of claim 1 above including the inter-treatment on the glue layer includes applying plasma to the glue layer (col. 3, lines 37-50).

Regarding claim 4, Wu teaches the entire claimed process of claim 1 above including selecting a reacting gas, a process time, a process temperature, a process pressure, and a reacting gas flow (refer to col. 3, lines 37-50). Wu teaches performing plasma treatment on the layer using different gases at certain plasma energy. Therefore Wu's process inherently requires adjusting reacting gas flow as indicated by the chemical formal, chamber temperature and process time.

Regarding claim 5, Wu teaches the entire claimed process of claim 1 above including the selected reacting gas is a hydrogen based gas (col. 3, lines 37-50).

Regarding claim 12, Wu teaches (figs. 2A-2E) a method comprising: depositing a dielectric layer (206a), depositing a glue layer (208) on the dielectric layer (206a);

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selecting a plasma treatment process (col. 3, lines 37-50); and applying the selected treatment process to affect the upper and lower surfaces of the glue layer (col. 3, lines 37-50, since layer 208 is exposed to the plasma treatment the upper and lower surface of 208 are affected); forming a metal layer (226) over the upper surface of the glue layer (206), wherein the treatment process enhances an adhesiveness between the dielectric layer (206a) and the metal layer (226, col. 3, lines 37-50).

The limitation of "a method for increasing a dielectric breakdown lifetime of a semiconductor device" is not given patentable weight because a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Furthermore since Wu teaches the same claimed process, Wu's process is inherently capable of increasing a time dependent dielectric breakdown lifetime of the semiconductor device.

Regarding claim 13, Wu teaches the entire claimed process of claim 1 above including the glue layer (208) with a certain thickness.

The limitation "the selected thickness is based at least partially on a desired electrical property of the glue layer" is not given patentable weight because the feature does not add anything to the process of forming the glue layer. Furthermore since Wu is

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concerned with forming interconnection structure therefore Wu's process is inherently concerned with finding the desired electrical property of the glue layer.

Regarding claim 14, Wu teaches the entire claimed process of claim 1 above including adjusting a property of the selected treatment process based on the selected thickness of the glue layer.

Wu teaches forming the treatment over a certain depth of the glue layer (fig. 2D). Therefore Wu is inherently capable of adjusting a property of the selected treatment process based on the selected thickness of the glue layer.

Regarding claim 16, Wu teaches the entire claimed process of claims 1 and 12 above including the glue layer is silicon nitride (col. 3, lines 1-9).

Regarding claim 17, Wu teaches the entire claimed process of claims 1 and 12 above including the selected process is the plasma treatment process, and wherein a reacting gas to be used in the plasma treatment process is hydrogen based gas (col. 3, lines 37-50).

Regarding claim 21, Wu teaches (figs. 2A-2E) a method for improving an interface in a semiconductor device (col. 2, lines 50-53) comprising: forming a first metal layer (202); forming a glue layer (208) on the first metal layer (202); performing an inter-treatment on the glue layer to alter upper and lower surfaces of the glue layer for improved adhesiveness (col. 3, lines 37-50, the plasma process affects the upper and lower surface of the glue layer 208); and forming a second metal layer (226) on the upper surface of the glue layer (208).

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Regarding claim 22, Wu teaches the entire claimed process of claim 21 above including the inter-treatment includes using plasma (col. 3, lines 37-50).

Regarding claim 23, Wu teaches the entire claimed process of claim 21 above including the material for the glue layer is SiN (col. 3, lines 1-9).

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu in view of Cox et al. US patent No. 5,851,927.

Wu teaches substantially the entire claimed process of claim 1 above except explicitly stating performing a pre-treatment on the first layer before forming the glue layer.

It is conventional and also taught by Cox performing a pre-treatment process on a silicon nitride film (col. 3, lines 15-32) in order to promote adhesion between the silicon nitride layer and subsequent layers.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the pretreatment process taught by Cox in the method of Wu in order to promote adhesion between the first layer and the glue layer.

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6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu in view of Xia et al. US patent No. 6,261,975.

Wu teaches substantially the entire claimed process of claims 1 and 4 above except explicitly stating that the selected reacting gas is a helium based gas.

It is conventional and also taught by Xia using helium based gas in the process of forming silicon oxide layer with an improved and stable layer (col. 8, lines 12-29).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the helium based gas taught by Xia in the process Wu in order to form glue layer that is stable (col. 8, lines 12-29).

7. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu.

Regarding claim 7, Wu teaches substantially the entire claimed process of claims 1 and 4 above except explicitly stating that the selected process time is between approximately 1 and 100 seconds, the selected process temperature is between approximately 200 and 400° C, the selected process pressure is between approximately 0.5 and 10 torr, and the selected reacting gas flow is between approximately 100 and 2500 sccm.

Parameters such as process time, temperature, pressure and reacting gas flow in the art of semiconductor manufacturing process are subject to routine experimentation and optimization to achieve the desired film quality during device fabrication.



Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made adjust the process time, temperature, pressure and flow as claimed in the process of Wu in order to form a high quality glue layer.

Regarding claim 15, Wu teaches substantially the entire claimed process of claims 1 and 14 above except explicitly stating duration of the selected treatment process.

Parameters such as process time are subject to routine experimentation and optimization to achieve the desired film quality during device fabrication.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made adjust the process time as claimed in the process of Wu in order to form a high quality glue layer.

8. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu in view of Murokh et al. US patent No. 5,798,146.

Regarding claim 8, Wu teaches substantially the entire claimed process of claim 1 above except explicitly stating performing the inter-treatment on the glue layer includes directing an electron beam towards the glue layer.

Murokh teaches (col. 1, lines 34-46) the application of electron beam on a dielectric layer in order to improve to the wettability and adhesive characteristics.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the process of applying electron beam on the

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dielectric layer taught by Murokh in the process of Wu in order to improve the adhesive characteristics of the glue layer.

Regarding claim 9, Wu teaches substantially the entire claimed process of claims 1 and 8 above including directing the electron beam towards the glue layer further comprises defining a process power and a dosage. Since applying electron beam requires using a certain amount of process power and electron beam density, the combined process of Wu and Murokh inherently teaches defining a process power and a dosage.

Regarding claims 10 and 11, Wu teaches substantially the entire claimed process of claims 1 and 8 above except explicitly stating that the process power is between approximately 1000 eV and 8000 eV and the dosage is between approximately 50 and 500  $\mu\text{C}/\text{cm}^2$ .

Parameters such as process power and electron beam dosage in the art of semiconductor manufacturing process are subject to routine experimentation and optimization to achieve the desired film quality during device fabrication.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made adjust the process power and beam dosage as claimed in the process of Wu in order to order to improve the adhesive characteristics of the glue layer.

### ***Response to Arguments***

9. Applicant's arguments with respect to claims 1-17 and 21-23 have been considered but are moot in view of the new ground(s) of rejection.

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**Conclusion**

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel A. Gebremariam whose telephone number is (571)-272-1653. The examiner can normally be reached on 8:00am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**DOUGLAS W. OWENS**  
**PRIMARY EXAMINER**

SAG  
April 7, 2006

